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DEPARTMENT OF AGRICULTURE

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COFFEE RESEARCH AND EXPERIMENT STATION, LYAMUNGU, MOSHI

Report for the period 1st January to 31st December 1943

ADMINISTRATION—STAFF LIST IN JANUARY 1943

Chief Scientific Officer: S. M. Gilbert, B.Sc. (Agric.), N.D.A., Dip. Agric. (Wye).

Plant Pathologist: G. B. Wallace, B.Sc. (Agric.), Ph.D. (Edin.).

Agricultural Assistant: L. M. Fernie.

Temporary Scientific Assistant: Mrs. G. B. Wallace, B.Sc. (Hons.), M.Sc. (Lond.).

Temporary Agricultural Assistant, in charge vegetable seed and galenicals production: Mrs. L. M. Fernie, B.Sc. (Hort.).

STAFF CHANGES

Until 11th August Dr. G. B. Wallace was in general charge of the station. Mr. S. M. Gilbert resumed charge on 12th August on termination of his secondment to Dar es Salaam as Controller (Distribution and Disposal of Controlled Produce); on 31st December he proceeded on special leave. On 4th December Mr. L. M. Fernie was transferred to Amani on his appointment as Superintendent of Plantations at the East African Agricultural Research Institute, and Mrs. Fernie resigned her post at the station. Mrs. G. B. Wallace was appointed as Temporary Scientific Assistant on 1st January, and was in charge of plant pathology.

CONTACTS WITH GROWERS

There were comparatively few visitors to the station, and opportunities for visiting plantations were limited. Several parties of Africans were shown the work being undertaken on the station. Fifteen local African coffee growers were given a three months' course of instruction. This covered all farm operations, in which the pupils themselves participated; the objects and methods were explained.

FINANCE

Details of expenditure for the year are given in Appendix I.

Revenue amounted to £677 5s. 0d., plus £38 the value of beans used in labourers' rations.

STATION DEVELOPMENT

During 1943 seven squares of coffee were planted in the clonal selection trials; the total planted by the end of the year was eight squares, approximately eight acres, while nine remain to be planted as rooted cuttings of certain selections become available.

The digging of a new furrow leading into the station has made it possible to irrigate ten coffee fields to advantage.

It has been recommended that an estimate be given of the acreage under coffee and the number of trees, by age groups, at June 1944. At that date station land is expected to be occupied as follows:—

		Acres	Change
Coffee:			
(a) under three years	12·17		
(b) 4 to 6 years	37·67	82·50	—5·5
(c) over 6 years	32·66		
Nurseries		2	
Bananas and fodder grasses		43·5	—1·5
Paddocks		30	
Coppices and wind belts		33	+6
In preparation for experiments		12	—4
Forest		30	
Roads, buildings, etc.		27	
Bush—cleared and uncleared		42·5	—5·5
Food crops		7·5	—0·5
Total		310	

Fifteen tons of coffee were produced, a very high proportion being grade "A".

METEOROLOGY

The total rainfall was 43·24 inches (1,098·4 millimetres), the lowest on record at this station. The average for ten years is 68·1 inches (the highest being 100·7 inches in 1937).

VEGETATIVE PROPAGATION

The number of cuttings successfully rooted was 5,979.

PESTS AND DISEASES

The long spell of dry, hot weather in the early months of the year greatly encouraged thrips, which caused leaf-fall and die-back in some fields. Hemileia incidence was below normal. Diseases of other crops are dealt with in publications from the plant pathology laboratory.

VEGETABLE SEED PRODUCTION AND MEDICINAL PLANTS

Quarterly reports were made by Mrs. L. M. Fernie, Temporary Agricultural Assistant. On 4th December, on the departure of Mrs. Fernie, this work was almost entirely discontinued. A large-scale trial with *Atropa belladonna* is being allowed to mature, as earlier trials gave promising results.

EXPERIMENTS ON STATION

Experiment I. *Method of planting—Planted 1935*

(a) MAIN PLOTS

	Mean yield, 1943		Mean of 6 years	
	Clean cwt. per acre	Percentage	Clean cwt. per acre	Percentage
No holing	17·11	117·7	8·43	106·8
*H3F1	17·42	119·9	8·95	113·4
†HF1	11·87	81·7	6·95	87·8
Hole sub-soiled:				
Without compost, H3F1	14·77	101·6	8·18	103·7
„ „ HF1	13·24	91·1	7·33	92·9
With compost, H3F1	14·54	100·0	8·19	103·8
„ „ HF1	12·74	87·7	7·21	91·4
Mean	14·53	100·0	7·89	100·0
Standard error	·65	4·5	·21	2·7
Significant difference, P = ·05	—	—	·63	8·0

*H3F1=Holed three months and filled one month before planting. †HF1=Holed and refilled one month before planting.

(b) SUB-PLOTS

	Mean yield, 1943		Mean of 6 years	
	Clean cwt. per acre	Percentage	Clean cwt. per acre	Percentage
Planting:				
Deep with ball of earth	14·36	98·8	7·41	93·9
Deep bare roots	13·37	92·0	7·12	90·2
At nursery level—				
With ball of earth	15·10	103·9	8·60	109·0
Bare roots	15·29	105·2	8·45	107·1
Mean	14·53	100·0	7·89	100·0
Standard error	·32	2·2	·14	1·8
Significant difference, P=·05	·91	6·3	·39	4·9

Conclusions from the above figures are as follows: The benefit from opening up holes three months in advance of planting, and refilling in good time to allow the soil to settle is maintained over the six-year period. Planting at nursery level continues to show advantage over deep planting.

No significant difference has resulted from planting seedlings with a ball of earth and with bare roots. Neither sub-soil nor the addition of compost have shown any advantage.

EXPERIMENT II. *Seedling Selection Trials*

Results from two years' figures are too variable for profitable discussion.

EXPERIMENT III. *Clonal and Seedling Trees—Planted 1937*

Grafting on to multiple stems is proceeding.

EXPERIMENT IV. *Seedling Stocks*

Square 2 was planted with the five best clonal selections.

EXPERIMENT V. *Mulch, Compost and Nitrogen*

The first crop was taken, and no conclusions can be drawn. There is, however, an apparent depressing effect of nitrogen on yield.

EXPERIMENT VIIA. *Conversion to Multiple Stem—Converted 1940*

	Mean yield, 1943		Mean of 4 years, 1940-43	
	Clean cwt. per acre	Percentage	Clean cwt. per acre	Percentage
Clean stump, 3 suckers	10·86	94·1	8·15	89·0
Cut off west side primaries, 3 suckers from bottom	11·88	102·9	9·84	107·4
Cut off east side primaries, 3 suckers from bottom	12·22	105·9	10·01	109·3
Cut off all except top 3 primaries, 3 suckers from bottom	12·90	111·8	10·18	111·1
Agobiada, multiple stem, 3 suckers	11·20	98·0	8·49	92·7
Top cut at 3 feet from ground and 3 suckers left to grow at top	9·67	83·8	8·49	92·7
Mean	11·54	100·0	9·16	100·0
Standard error	·68	5·9	·32	3·5
Significant difference, P=·05	1·88	16·2	·90	9·8

Among the six methods of conversion from single stem to multiple stem, three are significantly better than the other three as regards yield over the four-year period. The three best methods according to these results are the second, third and fourth, that is, cutting off the east or west primaries, or all except the top three, in each case three suckers being developed from the base. The least successful methods were Agobiada, cutting the top at three feet and clean stumping.

Experiment IX. *Methods of Cultivation—Planted 1934*

	Mean yield, 1943		Mean of 6 years, 1938-43	
	Clean cwt. per acre	Percentage	Clean cwt. per acre	Percentage
Treatment:				
Forked hoe (forked jembe)	7·86	116·3	4·59	109·3
West Indian hoe (Jembe)	7·73	114·3	4·57	108·8
Nil	7·17	106·1	4·42	105·2
Envelope forked	5·26	77·8	3·46	82·4
Trenched	5·80	85·8	3·98	94·8
Mean	6·76	100·0	4·20	100·0
Standard error	·12	1·8	·32	7·6
*Significant difference	—	—	—	—

*The results are not significant.

Experiment X. *Artificial Shade—Planted 1937*

Treatments will be resumed when webbing again becomes available. Crop figures are being recorded.

Experiment XI. *Kents* versus *Bourbon—Planted 1935—Summary of Results, 1938-43*

	Clean cwt. per acre	
	Kents	Bourbon
1938	7·69	7·12
1939	4·86	3·11
1940	3·70	5·10
1941	12·87	9·51
1942	5·72	9·34
1943	11·84	8·01
Mean	7·78	7·03

In this comparison of yields from Kents and Bourbon coffee, statistical data are not available. Results from year to year have been variable, but on the average of six years' figures, Kents has yielded rather more than Bourbon.

Experiment XII. *Selection in Nursery—Planted 1935*

	Mean yield, 1943		Mean of 6 years, 1938-43	
	Clean cwt. per acre	Percentage	Clean cwt. per acre	Percentage
Tops cut back	5·85	89·6	3·90	90·9
Good tops and good roots	9·28	142·1	5·30	123·5
Average	6·59	100·9	4·31	100·5
Good tops and poor roots	6·02	92·2	4·48	104·4
Poor tops and good roots	6·39	97·9	4·00	93·2
Poor tops and poor roots	5·09	77·9	3·69	86·0
Mean	6·53	100·0	4·29	100·0
Standard error	·75	11·5	·33	7·7
Significant difference, P = ·05	2·29	35·1	·98	22·8

Over a period of six years the only significant difference in crop is in the trees from seedlings chosen for good tops and good roots. These are significantly better than trees from the seedlings with either the tops cut back, or with poor tops or both poor tops and poor roots.

Experiment XIVa. *Mulch Experiment—Planted 1940*

(a) Plot yields

	Mean yield, 1943						Mean of two years, 1942-1943					
	Main Plots		Without Nitrogen		With Nitrogen (S.A.) 4 oz. per tree		Main Plots		Without Nitrogen		With Nitrogen (S.A) 4 oz. per tree	
	Clean cwt. per acre	Percentage	Clean cwt. per acre	Percentage	Clean cwt. per acre	Precentage	Clean cwt. per acre	Percentage	Clean cwt. per acre	Percentage	Clean cwt. per acre	Percentage
Treatment:												
Nil	4·86	101·8	5·04	96·9	4·68	107·8	3·31	102·2	3·36	97·4	3·24	106·9
Banana mulch (80 lb. per tree) ...	4·46	93·3	4·82	92·5	4·09	94·2	3·18	98·1	3·39	98·3	2·97	98·0
Elephant grass (80 lb. per tree)...	4·61	96·4	4·67	89·6	4·55	104·8	3·19	98·5	3·27	94·8	3·17	104·6
Guinea grass (80 lb. per tree)	5·02	105·0	5·87	112·5	4·18	96·3	3·41	105·2	3·78	109·6	3·04	100·3
Compost (50 lb. per tree) ...	4·93	103·1	5·63	108·9	4·23	97·5	3·09	95·4	3·48	100·8	2·71	89·4
Mean	4·78	100·0	5·21	100·0	4·34	100·0	3·24	100·0	3·45	100·0	3·03	100·0
Standard error (a)	0·22	4·6	0·13	2·5	0·13	3·0	0·21	6·5	0·09	2·6	0·09	3·0
Significant difference (a)	–	–	0·36	6·9	0.36	8·3	–	–	0·25	7·2	0·25	8·5
Standard error (b) Interaction* ...	–	–	0·28	5·9	0·28	5·9	–	–	–	–	–	–
Significant difference (b) Interaction*	–	–	0·80	16·8	0·80	16·8	–	–	–	–	–	–

(b) Mean of two diameters in millimetres

Treatment:									
Nil	42·8	43·9	41·6	–	–	–	–	–	–
Banana mulch (80 lb. per tree) ...	45·8	47·6	44·0	–	–	–	–	–	–
Elephant grass (80 lb. per tree)...	44·1	46·2	41·9	–	–	–	–	–	–
Guinea grass (80 lb. per tree) ...	46·1	49·2	43·1	–	–	–	–	–	–
Compost (50 lb. per tree) ...	42·0	43·2	40·8	–	–	–	–	–	–
Mean	44·2	46·0	42·3	–	–	–	–	–	–
Standard error	1·23	0·10	0·10	–	–	–	–	–	–
Significant difference, P= ·05 ...	†	0·30	0·30	–	–	–	–	–	–
Interaction significant difference ...	–	2·2	2·2	–	–	–	–	–	–

*Differences between main plot yields and for interactions do not pass the "Z" test. Those between nitrogen and no nitrogen are significant for P=·05. †The results are not significant for main plots.

In both years nitrogen appears to have had a slight depressing effect on yield. The results from the main plots yields over two years are not significant, and cannot yet be discussed to advantage. Compost which reduced yields in 1942, has shown no effect either way in 1943.

Experiment XIII. *Type of Growth—Planted 1936*

	Mean yield, 1943		Mean of 5 years, 1939-43	
	Clean cwt. per acre	Percentage	Clean cwt. per acre	Percentage
Single stem	5·4	45·4	4·85	61·5
Multiple stem, 3 suckers	17·2	144·5	11·51	145·9
Multiple stem, 3 suckers Agobiada	13·1	110·1	7·31	92·7
Mean	11·9	100·0	7·89	100·0
Standard error	·56	4·7	·35	4·4
Significant difference, P=·05	2·92	24·5	1·20	15·2

In the five years of the first cycle of the multiple stem trees, these have heavily outyielded trees on the other two systems of growth ; also, the Agobiada form of multiple stem is considerably better than the single stem trees.

Experiment XIV. *Mulch Experiment—Planted 1935*

	Mean yield, 1943		Mean of 6 years, 1938-43	
	Clean cwt. per acre	Percentage	Clean cwt. per acre	Percentage
Banana mulch (100 lb. per tree)	8·26	135·5	7·74	124·6
Guinea grass mulch (100 lb. per tree)	8·03	131·8	7·37	118·5
Banana mulch (50 lb.) plus sulphate of ammonia (½ lb.)	9·29	152·4	6·34	102·1
Elephant grass mulch (100 lb.)	6·27	102·8	5·37	86·5
Clean weeded	4·41	72·4	5·77	92·9
Weeds as mulch	3·73	61·3	5·11	82·3
Elephant grass mulch (50 lb.) plus sulphate of ammonia (½ lb.)	4·80	78·7	5·73	92·3
Compost (50 lb. per tree)	4·04	66·4	6·25	100·6
Mean	6·10	100·0	6·21	100·0
Standard error	1·12	18·3	·30	4·8
Significant difference, P=·05	3·20	52·5	·85	13·7

In this mulch experiment banana mulch and guinea grass mulch still maintain their superiority over the other treatments. The heavier yield from banana mulch plus sulphate of ammonia in 1943 brings this treatment from sixth place over five years to third place over six years. The 1943 yields indicate that the plots under the third and fourth treatments may be recovering from the harmful effects of cover crops in earlier years.

Experiment XV. *Irrigation and Mulching—Planted 1940*

This experiment has given noteworthy results in the first two years of bearing. So great are the increases in the mean yields of treated plots as compared to those of the untreated plots that no analysis is required. The studies of interactions between treatments, however, would, in view of the large differences in means, appear to require special statistical analysis. Expert advice is being requested. The general trend of increases in yields as seen from the table on page 7 appears to be directly as the increase in amount of mulch and/or irrigation, with the exception of fortnightly applications which seem to be too frequent. The yield results are confirmed by growth measurements. The information is of sufficient interest to publish in its present incomplete form.

An account of this experiment will be published in detail, in due course, as its results may have a profound influence on coffee culture in East Africa.

SUMMARY OF RESULTS

Treatments *Water	†Mulch	Yield clean cwt. per acre 1942	Girth measurement in mm. 1942	Yield clean cwt. per acre 1943	Girth measurement in mm. 1943	Mean yield for 2 years clean cwt. per acre
Nil	Nil	0·53	31·6	3·09	38·4	1·81
Nil	50 lb. once a year	1·86	42·5	7·55	50·5	4·71
Nil	100 lb. „	2·34	44·8	8·54	53·8	5·46
Nil	50 lb. twice a year	1·55	42·6	6·97	52·8	4·26
Monthly: 2 ins.	Nil	0·87	37·5	6·47	47·4	3·67
„	50 lb. once a year	2·41	43·8	11·18	59·0	6·80
„	100 lb. „	2·50	47·7	12·03	59·3	7·24
„	50 lb. twice a year	2·60	45·7	11·02	57·4	6·81
Monthly: 4 ins.	Nil	0·90	38·9	8.20	49·9	4·55
„	50 lb. once a year	2·54	48·4	13·16	62·1	7·85
„	100 lb. „	3.21	48·8	10·45	60·9	6·83
„	50 lb. twice a year	2·28	45·6	9·29	62·0	5·79
Fortnightly: 2 ins.	Nil	1.71	44·9	7·31	55·0	4.46
„	50 lb. once a year	2·36	47·6	9·52	62·0	5·94
„	100 lb. „	2·98	46·0	8·96	63·2	6·24
„	50 lb. twice a year	2·10	46·1	7·53	61·2	4·81

*Rainfall is made up to the quantity mentioned by means of irrigation. No irrigation is given if the rainfall exceeds the treatment. †Banana trash.

The guard row trees in this experiment are from seedlings taken from what is considered the best selection. They are on multiple stem, and have had no treatment supplied. The weight of the 1943 crop was at the rate of 8·32 hundredweights of parchment coffee per acre.

It is important to know how the seedling progeny of a selected mother tree will behave, and it is therefore satisfactory to be able to record very promising results from the first crop's liquoring test. Samples were taken in 1943 from the 657 guard row trees, now three years old. In both Tanganyika and Kenya liquoring tests, the samples were reported as fine quality coffee—for raw, roast and liquor classifications high marks were given.

Other experiments in which the progeny are being studied are in the single-tree progeny plot, the clonal selection trials, and the age experiment, No. XVII.

Experiment XVII. *Age*

The seventh of the eight groups of plots was planted. There will ultimately be coffee of eight ages to compare in liquoring tests.

STOCK

The health and milk yields of the cattle have been maintained. After a two-year interval, one case of trypanosomiasis was detected at the end of the year; it responded to treatments with *Stibophen*.

At the end of the year the stock consisted of—

Kind	Number
Stud bull	1
Cows and in-calf heifers	20
Heifers due to breed	1
Heifer calves	16
Young bulls	2
Bull calves	16
Donkeys	1
Total	57

FODDER GRASSES, Etc.

Fodder grasses, paddocks and bananas suffered from the dry weather this year. The new furrow referred to on page 1 of this report will in future serve some of the paddocks. The elephant grass time-of-cutting experiment has been discontinued, but otherwise the acreage of bananas and grass has been maintained.

Lyamungu, Moshi,
14th April 1944

G. B. Wallace,
Acting Chief Scientific Officer

STATEMENT OF EXPENDITURE FOR THE PERIOD 1ST JANUARY TO 31ST DECEMBER 1943

I.—Personal Emoluments

Item No.		Provision Shs.	Cts.		Expenditure Shs.	Cts.
3.	Chief Scientific Officer			...	12,000	00
	Temporary Scientific Assistant			...	7,200	00
12.	Agricultural Assistant			...	7,098	38
19.	Clerks (L.C.S.)			...	4,175	00
21.	Recorders			...	6,693	48
22.	Mechanics	44,894	00	...	3,673	07
25.	African Laboratory Assistants			...	88	06
26.	Overseers			...	660	00
27.	Motor Driver...			...	540	00
28.	Messengers			...	344	30
		44,894	00	...	42,472	29

II.—Other Charges

31.	Travelling Allowances	660	00	...	106	80
32.	Transport Allowance	1,750	00	...	1,099	09
33.	Transport	1,000	00	...	404	00
34.	Railway Fares and Freight	800	00	...	875	32
35.	Maintenance and Running of Motor Vehicles ...	3,000	00	...	2,483	96
36.	Bicycles	50	00	...	38	07
37.	Books of Reference	300	00	...	157	42
38.	Contingencies	300	00	...	149	16
40.	Stationery	500	00	...	100	54
54.	Upkeep of Agricultural Stations	1,000	00	...	599	74
56.	Upkeep of Coffee Research Station:					
	(a) Labour			...	22,768	73
	(b) Field Experiments off Station			...	—	
	(c) Maintenance of Power, Gas, etc.			...	2,787	58
	(d) Upkeep of Coffee Factory	31,700	00	...	1,394	99
	(e) Upkeep of Stock			...	1,674	66
	(f) Equipment and Materials			...	2,675	09
	(g) Uniforms			...	33	16
	(h) Trials of Clonal Coffee...			...	2,250	00
		41,060	00	...	39,598	31
	Outstanding accounts on Crown Agents' Indents and Railways	—		...	1,000	00
		41,060	00	...	40,598	31
62.	Increased Food Production. (b) Production of Vegetable Seed:					
	(1) Salary of Temporary Agricultural Assistant			...	4,400	00
	(2) Labour	8,000	00	...	1,992	83
	(3) Purchase of Seed			...	63	41
	(4) Equipment			...	287	17
		8,000	00	...	6,743	41